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ABSTRACT

An action research study was undertaken to examine the effects of educational technology resources on critical thinking and analytical skills. The researcher observed 3 different 11th grade classes, a total of 75 students, over a week as they worked in the school's computer lab. Each class was composed of 25 to 30 students, all of whom were considered "noncollege bound" or below-grade level academic status. The researcher prepared a list of questions and then interviewed students at random to determine their responses to the use of technology and the WebQuest software unit on World War II. An interview was also held with the teacher. Findings from the students and the teacher supported the hypothesis that educational technology supported the critical thinking and analytical skills of students who were below grade level or not planning on college. (Contains 1 table and 10 references.) (SLD)

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The Effects of Educational Technology Upon the Critical Thinking and Analytical Skills of Below Grade-Level and or Non-College Bound High School Students

EDUC 595
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To fulfill my action research requirement and as a candidate for a Master's Degree in the *Teaching and Learning with Technology* program, I have scheduled a research project into my semester's academic plans. My research study will involve examination of the effectiveness which educational technology resources and activities have upon the critical thinking and analytic skills of below grade-level and non-college bound students.

I have arranged to work with a history faculty at school near my university. This instructor will be conducting a unit, which involves the use of educational technology resources in order to assess the critical and analytical thinking skills of his students during the month of March, 2003. He has three classes which each include 20 to 25 students.

Much of my work in the *Teaching and Learning with Technology* program has been dedicated to the study and application of educational technology resources and their ability (if applied correctly) to provide an environment of authentic and meaningful instruction for students in public schools. This practice further makes possible, the concept of a "lifelong learning" experience for young people. This concept is in part, the goal of every public school's mission, as these institutions strive to prepare children to be productive and responsible members of society.

This in turn, is the reason for my interest in surveying the perceptions and attitudes of below-grade level and non-college bound students toward being exposed to activities, which challenge their critical thinking and analytical skills. Such activities are unfortunately too often reserved only for students who are college-bound and or above grade-level. When educational technology resources are used for non-college bound and or below grade-level students, they

come in the form of drill and practice exercises, which assess very little other than rouge learning and recall skills. Lessons that defy this trend may be extremely valuable for me to study in order to enhance my abilities to teach with technology meaningfully.

As I ascend to a history teaching position, I will be eager to bring the information that I have obtained from this study into my classroom. I am thoroughly prepared to be working with talented students who see higher education in their future. However, I also am quite ready to educate students who are perhaps less fortunate and do not foresee a college education in their future. This fact alone should never leave non-college bound students without the equal opportunity to receive meaning and authentic learning experiences through the use of educational technology while in the public schools.

Throughout my course work in the teaching and learning with technology track, I have read about several case studies and research projects that have taken place in public school districts in all parts of this country. The conclusion and hypothesis of many of these projects proposes an overall improvement in the quality of education, attitudes, and perceptions of students toward the curriculum, when educational technology resources are utilized. I am a firm believer in this hypothesis and would like to try my own version of these studies to confirm my beliefs and speculations.

Even when my research project is finished and I have earned my master's degree in *Teaching and Learning with Technology*, the value and usefulness of my skills will be imperative to me as a growing professional in the field of education. With every passing day our society becomes more and more technologically advanced. Being able to understand these advances and relay them to young people will undoubtedly become an enormous part of the curriculum (and already is in some counties) that I will be fully responsible for teaching.

In an increasingly digital society, the growing technological demands of the population will undoubtedly emerge in the public schools. My course work in the *Teaching and Learning with Technology* program will prepare me for these apparent demands, but my research study will allow me to have a specific and realistic view of what my job will have the potential to address in the coming years. Learning about what helps students or what they feel is beneficial to their education will provide an incredible insight into how I will teach and interpret the curriculum as a history teacher. When coupled with my abilities to effectively teach and learn with educational technology, my research findings will give me an edge in my field, which will translate into my classroom becoming a positive place for young people to learn.

Educational technology resources can have a positive effect upon student learning. Studies have shown that the critical thinking and analytical skills of students are positively impacted when technological manipulatives are present during a lesson or unit. Computer labs with software packages including word processors, spreadsheets, databases, and presentation software as well as projection devices like LCDs are the teaching tools of the future. Research studies highlighting the use of these items have shown significant academic improvement for students of all age groups and ability levels.

The general trend in using technological resources as part of lesson and unit planning is for "honors" or "gifted and talented" students to receive the majority of the exposure. When this common practice is defied and educational technology is utilized to hone the critical thinking and analytical skill of below grade-level and non college-bound students, many findings still show a positive relationship upon the skills of these students. There are very few studies that have taken place which cover this specific topic, but the appropriate data appears in many more general or large studies.

Michael Hopson (2002), in the *Journal of Research on Technology in Education* examined the effect that a "technology-enriched" classroom would have upon the higher order thinking skills and attitudes of students toward computer use. Within this study, numbers were fielded to represent the effects that a technologically-enriched environment would have upon students who were below grade-level. As hypothesized by Hopson, the exposure to technological resources increased productivity and enrichment levels across the board, for all student groups, including those to be considered below grade-level or non college-bound.

Another published study conducted by the Southeast Initiatives Regional Technology in Education Consortium (2001) or "SEIR TEC." This group has shown that technology in the classroom benefits all academic aptitudes in many areas, including critical thinking and analytical skills. Much like Hopson's study, a lot of the work involves subjecting random groups of student to classrooms which utilize technology for meaningful learning, and studying the results against a comparison group which was exposed to more traditional forms of educational delivery. The overall finding again supported that exposure to lessons which use technology, had a positive effect upon (among other skills) the analytical and critical thinking abilities of many groups of students, even those that were not planning to attend college and or achieved below their grade-level.

The work of John Cradler and Mary McNabb (2002) in *Learning and Leading with Technology* Journal also complemented the overall notion that technology in the classroom aids the critical thinking and analytical skills of underachieving and or non college-bound students. Cradler and McNabb focused on three key issues within the goals of curriculum planning. Goals two and three in this list included the ability of educational technology to positively impact "higher-order thinking and problem-solving skill development," as well as "Workforce preparation." This study's findings, in the area of questions two and (especially) three, shed a lot of light upon the exploration of educational technology's impact in the classroom. In nine states across the country, students who were exposed to educational software programs outperformed students in comparison classes by 100% on tests targeting curriculum-focused objectives, part of these objectives include of course, critical thinking and analytical skills among all groups of students.

Harold Wenglinsky is another leader in the teaching and learning with technology field. In 1998, he conducted a study titled, *Does it Compute: The Relationship Between Educational Technology and Student Achievement in Mathematics*. This project lived up to its title. Just as with much of the other literature that explored the association between educational technology and student performance, Wenglinsky cited significant evidence to support the overall effectiveness of education technology upon the achievement of young people in the classroom. Although much of this research took place in Mathematics classrooms the theme is consistent. There is an overwhelming amount of evidence to suggest that technology-enriched classrooms can be more conducive to meaningful and authentic student learning. Within his study, Wenglinsky takes the time to point out that many schools have vast technological resources at their disposal, but simply use them in improper ways. Furthermore, he comments that this is the reason why the movement for technological resources to be introduced into public school classrooms has met a significant amount of skepticism. He thoroughly studied the factors which contributed to wrongful uses of technology. He then theorized about remedying these erroneous uses, citing positive outcome possibilities that could be experienced with proper training and execution of educational technology training.

In *Journal of Research on Technology in Education*, Michael Page (2002) investigated the effects of technology on the academic achievement of low socioeconomic status elementary students. In particular, this research examined the sense of worth that students developed or maintained as a result of their exposure to technology, and the interactions that were also a result of that exposure. Page compared the accomplishments of elementary students in technology-enriched classrooms to the accomplishments of students in elementary classrooms that have not been enriched by technology. Some academic areas that were specifically considered were

student achievement, self-esteem, and classroom interaction. Page (like Wenglinsky) was committed to clarifying the various views held by many professional institutions that technology's impact upon learning was insignificant. Some specific areas that this research touched on summarized various educational accomplishments, which have been credited to the use of technology in the classroom. Page hypothesized that, Higher scores on the CAT (California Achievement Test), more student collaboration, creative projects, higher students confidence, and accurate student communication, would emerge from technology-enriched classrooms, whose teachers adapted their lesson planning to accommodate the use of technology. As the research concluded, it was found that the students in the technology-enriched classrooms appeared to score significantly higher in mathematics achievement than the students in the traditional classrooms. As a result of the type of instruction resulting in technology-enriched classrooms, the classroom interaction was increased and found to be of a higher quality. There was also evidence of increased student initiated interaction in addition to teacher lead instruction. This study would thoroughly benefit a research project, which looked at the effectiveness of educational technology upon the critical thinking and analytical skills of lower-achieving and or non college-bound students.

Bernajean Porter (2003) in *Learning and Leading with Technology Journal*, addressed the need for proper educational technology planning to take place in public schools, in order to induce a change toward a lifelong learning experience for all children. In supporting this argument, this article also pointed out the strong correlation which exists between technology-enriched classrooms and quality student achievement. Porter made note of a three-phase system of educational technology implementation and maintenance, which has been successful in many Illinois school districts. Much of this article sheds light upon the future of technology in the

classroom and how that future could be in jeopardy, regardless of its overwhelming effectiveness. This negative outcome was made apparent through Porter's research, as she pointed out that if schools do not properly assess and document their effective usages of technological resources in the classroom, future funding for these resources could be in question:

> "As long as the results from our technology resources are not understood or not valued, future funding and support will be questionable. The question is not, 'What has technology done for education?' Rather, it is 'What can technology do for our kids if we consciously use the power of technology to reorganize and reshape our schools in way that prepare students to thrive in a changing, complex world?'" (12)

Like many of the other elements of research on technology's effectiveness in the classroom, especially with below grade-level learners, Porter advocated the use of technology by teachers and students alike. Her focus on the lack of public schools' attention toward retaining funds for educational technology resources despite their effectiveness would support a study that focused the appropriate use of technology in order to positively influence meaningful learning.

Judith Sandholtz and Cathy Ringstaff (1994) of the Apple Computer Corporation, initiated the "Apple Classrooms of Tomorrow" (ACOT) study to prove that the introduction of technology can significantly increase the potential for learning. This especially, was thought to be true "when it is used for collaboration, information access, and the expression and representation of students' thoughts and ideas (5)." More specifically, the ACOT group theorized that, providing immediate access for teachers and students to computers, videodisc players, video cameras, scanners, CD-ROM drives and online communication services with an approach to educational change that integrates new technologies and curricula with new ideas about learning and teaching can help schools realize this potential for learning. The study also addresses the

importance of student engagement in technology and how teacher management styles, student grouping, and instructional activities have an effect on engagement. Much like other studies whose hypotheses were in support of educational technology usage in the classroom, the ACOT study's findings pointed toward heightened achievement in association with educational technology resource presence in lesson planning. Attitudes and perceptions from students saw a significant change according to Sandholtz and Ringstaff (35). Due to this resurgence of enthusiasm, students seemed to be more productive and more likely to do extra work. Many students asked for more assignments or more time to work on projects that interested them. This all pointed toward a meaningful learning experience for each child. The findings that were perhaps the most valuable to a study examining technology's effectiveness upon below grade-level and non college-bound students, were that many students who had not originally done well in the typical classroom setting would thrive in the technological setting. Increased initiative, risk taking, and experimenting, were all results of the ACOT research study. This information alone, made the ACOT publication a valuable piece of research to be examined.

The Center for Applied Research in Educational Technology (CARET, 2003) has compiled much information in association with student achievement upon exposure to educational technology. In a recently published series of studies, two key questions were posed to the educational community as to the roll of educational technology resources' impact upon student learning. One question asked, "How can technology develop higher order thinking and problem solving?" Another inquired about performance, "How can technology influence student academic performance?" Each explorative response to these questions was multifaceted, and looked at many avenues for information. CARET found that higher order thinking and problem solving skills were efficiently when students are shown how to apply the process of complex

problem resolution and then are given opportunities to apply technology in the development of solutions to these complex problems. As far as the development of higher order thinking skills, CARET saw this concept exercised effectively by students when they worked in collaborative groups, and used technology resources to design answers to intricate questions. Also, it was found that the presentation software (PowerPoint) offered by the computer labs in many technology-enriched schools had positive outcomes on student development when used as a communication tool to share the results of projects and experiments. CARET also pointed out that technology in the classroom could have a positive influence upon other areas of academic performance. This concept was found to be most prevalent when the application of technology was used to directly support the curriculum objectives being assessed. Also, just as in the answer to the first question (How can technology develop higher order thinking and problem solving?), it was found that collaborative student groups using technology was the most conducive scenario to increase student achievement. It was also seen that the students who were given the opportunity to design and implement projects that extended the curriculum's content requirements were more successful with the concepts when they experienced them again on standardized tests. All of this vast evidence amounted to a useful source of reference when investigating technologies influence upon the critical thinking and analytical skills of below grade-level learners.

In a study documented by Dale Mann and Charol Shakeshaft (1999) entitled, *West Virginia story: Achievement Gains From a Statewide Comprehensive Technology Program*, research was conducted in 18 elementary schools in order to see under what conditions technology was effective in advancing learning and teaching within the schools. The goal of this research was to understand the study and make the understandings known to others. This way,

other (school districts) could reap the benefits of the system design, training, technology capacity, technical support, and means of measurement inherent in such a large-scale study. The author hypothesized that West Virginia's achievement gains were directly related to the Basic Skills/Computer Education (BC/CE) instructional technology initiative that was instituted during the 1990-1991 school year. They also felt that academic achievement would increase when technology was used within the schools. The findings confirmed many of the hypotheses, stating that, Basic Skills/Computer Education worked to increase academic achievement in the vast majority of cases. The program was especially successful with low income and rural students as well as with females. Students without computers at home made the biggest gains in total basic skills such as, total language, language expression, total reading, reading comprehension, and vocabulary skills (10). Teachers reported higher skill levels in delivering instruction, planning lessons, managing paperwork and word processing. Those with Basic Skills/Computer Education computers in their classrooms saw computer use increase with reading, math use, and writing instruction. More than 50 percent of those instructors, who had access to computers in their classroom, said that they felt confident in using computers in their teaching (12). All of these findings made the West Virginia document a valuable one for studying technology's effectiveness in the classroom.

In relatively short time period, many research studies can be located which support the use of educational technology in order to increase meaningful learning in the classroom. Too often however, much of this technological education is reserved for "gifted and talented" groups of students. However, when below grade-level and non college-bound students are exposed to these resources (as is done in a portion of many of these studies) the results match the

hypothesis. Indeed, educational technology has positive effects upon the critical thinking and analytical skills of all students.

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In studying 11th grade U.S. History students, I examined the effectiveness of educational technology resources upon critical thinking and analytical skills. To properly study this concept, I observed three different 11th grade classes over a period of seven days, as they worked in the school's computer lab. Each class was composed of between 25 and 30 students, all of which were considered to be of "non-college bound" and or below grade-level, academic status. Each class period was 50 minutes in length, and I joined each class for a total of 7 class periods. This came out to approximately 18 hours of total research.

Each student was paired with another classmate for the duration of the project. Each group was required to complete a "WebQuest" activity on World War II. The requirements of the "WebQuest," included: 1) Completing a presentation outline. 2) Completing a timeline of events. 3) Completing a storyboard to design a PowerPoint. 4) Completing a PowerPoint presentation of 6-8 slides. 5) Providing citations for information and images. 6) Presenting the PowerPoint to the class.

The groups were instructed to pick one of four questions from which to base their presentation topic on. The questions included: 1) Why did the U.S. enter the war? 2) Why did the U.S. win the war in the Pacific? 3) How did the U.S. help win the war in Europe? 4) How did the U.S. change at home during the war? Also Included within the "WebQuest" was a multitude of resources for researching all four of the questions.

On the first day of the project, I introduced myself to the classes as a graduate student and an observer. I explained to them that I was simply interested in some of the feelings and perceptions they possessed in association with using educational technology for more in-depth

research an analysis of history, rather than in a "drill and practice" format. I also explained that I would never need to know their name for any reason throughout my time in their classroom, and that they may have chosen not to answer any of the questions that they did not feel comfortable answering.

After I thoroughly explained my purpose in their classroom over the duration of their computer lab time, as well as their complete anonymity in my study, I let the academics take over and spent much of the first two class periods walking around to observe the groups' initial progress. As I observed, I was looking for a few key characteristics from the groups. I examined the effectiveness of their usage of the provided Internet resources as well the efficiency of their computer skills. It was obvious that all of the classes had participated in these activities before, because their familiarity and ease with the Internet and other software programs was notable.

It was also during these few initial class periods, that I took the opportunity to ask the classroom instructor and special education instructor (this staff member was required to be present in all classes because of high amount of "Individualized Education Plan") about the students' previous performance with educational technology resources in the "WebQuest" format. I made note of the explanations that both of these teachers gave me about the students' previous experience with activities similar to "WebQuests".

Because the students were just beginning the projects, I realized that there was a lot of work for them to do and that it was most likely inappropriate for me to disturb this process by asking direct questions. Instead, I simply looked "over the shoulder" of many groups throughout the class period. I walked around the rows of the computer lab and paid close attention to what pages they were looking at on the Internet resource list and what information from those pages that they were transposing onto their presentation outline and timeline (requirements 1 and 2 of

the project). I was particularly looking at the discussion that was taking place between group members as to what reference material was going to be included in their presentation and what was going to be omitted. In short, I was surveying each group's ability to separate the key information concerning their presentation topic question, from the more general facts about World War II. I followed this practice for the first two class periods of my study and recorded my findings.

By the third class period, I felt that the students were far enough along with their research that they could field a few questions about their progress and feelings toward using educational technology. To do this I took a very non-threatening, casual approach, which the students seemed to respond well to. I compiled a list of 10 questions to ask the groups. Five of these were originally supposed to have been asked orally in an interview format, while the other five were to be administered in written format to the students. Based on the students' attention span and behavior issues, I opted to ask all 10 of the questions in an oral format and to record their answers.

I again informed the students not to tell me their names and that they were not required to answer any of my questions. I began this interview process slowly, by going around to each group and asking one of the five questions on my "face to face interview questions for students subjects list. As I went from group to group, I alternated the question that I asked based on proximity. I wanted to avoid one group hearing what I had asked another group and simply giving me the same answer to the same question. By the time my first round of questioning was completed I had asked each of the initial five questions at least 12 times each, and made contact with all 39 groups (36 groups of two and 3 groups of one, all divided evenly over 3 separate class periods) this process took the entire third day of my study as well as half of the fourth day. I

followed this same exact process for all three class periods. I recorded my finding as I moved from group to group.

During the second half of the fourth day, I sat at a desk in the back of the classroom and began analyzing my findings. This break in interviewing served a dual purpose in my study. I wanted to familiarize myself with any trends that may have been emerging in the learning styles and strategies of the students. I also wanted to temporarily remove myself from the classes so that my presence did not overwhelm them and have negative repercussions upon their performance on the "WebQuests."

At the beginning of the fifth day, I began asking the five questions that were originally outlined as a survey in my initial action research project application presented to HSRB to all three class periods. As previously stated, I instead asked these questions to the students orally, following the same exact process as I had undertaken at the beginning of the third day of my research. Also as before, I did this with all three of the class periods. I recorded my findings as I moved from group to group.

Most of the groups had begun constructing their PowerPoint presentations during the third and fourth days of my research, and continued this into the fifth day. Since the majority of my questioning had already taken place, and nearly all of the groups were still only three quarters of the way through constructing their PowerPoint presentations, I decided to change gears slightly. I next immersed myself into the technical aspects of the presentations. I utilized all the skills that I had obtained at that point in my master's program to observe the completion of each groups' presentation. At this point I took mental note of what technical trends and issues were emerging as each group was coming down the home stretch with the PowerPoint software. I wanted to observe how the critical thinking skills of the students would transform the reference

information from the Internet into an intricate solution to the complex question about World War II that was presented in the "WebQuest." This process was followed for the entire fifth day of all three periods. I recorded my findings as I moved from group to group.

During the sixth day of my research I again rotated from group to group, asking follow up and conclusion questions about their projects. I again followed the alternating process with the groups in each class, this time asking from a list of three questions. These questions included:

1) How would you describe your knowledge of World War II, in particular reference to the (one of four) questions that you were required to answer for this WebQuest?

2) Did you find this project to be a realistic one based on your own learning styles and needs? Why or why not?

3) Would you say that your overall understanding of World War II was increased through the use this activity? Why or why not?

I asked each of these questions at least 12 times each to a total of 39 groups over three class periods. At the end of this process I compiled a findings and observations list for all six days of my research and prepared for the seventh and final day of research. This would be completed made up of group presentations and my observation of them.

On the seventh day of my project I watched each group present their PowerPoint presentations and give their final answer to the question they had chosen to research in association with World War II. Here I watch for the ultimate culmination of information into practice. I was interested in how efficiently each group took the information that they researched and solved the question that they had been posed. I recorded some of the notable points and highlights that resulted from this final day.

My very last step was to interview the class instructor and special education instructor as to their assertions of how effectively the class performed with their assignments. I asked both

subjects the five questions located on my "face to face interview questions for instructors" page. These questions were asked in written format and returned to me roughly 24 hours after I submitted them to the subjects.

I found the alternating style of questioning that I used with the student subjects to be successful for both quality of response and frequency potential. I was able to ask each of the questions several times and received answers that were very useful to my research.

When my entire research process was finished I reorganized my findings into separate categories. These categories were:

1) First round question findings
2) Second round question findings
3) Presentation notes/findings
4) Instructor question findings
5) Miscellaneous findings

This was the most logical format from which to begin my findings analysis report.

In analyzing the critical thinking and analytical skills of below grade level and or non college bound high school students, it was hypothesized that educational technology resources would increase the productivity of these abilities.

The students were required to complete an Internet-based WebQuest activity. The requirements of which were discussed earlier, in the "procedures" section of this project. I examined the students' performance on this activity in three specific ways. I first asked questions to the students in an interview style over the course of about 4 days. Next, I viewed the final presentations of all of their WebQuest projects. Lastly, I interviewed the classroom teacher as to his feelings about administering WebQuests to students. The information that came about upon completion of the study, consistently matched the hypothesis in many of the instances.

As expected, the students worked through the assignment and manufactured products, which exhibited critical thinking and analytical skills. These findings showed that three classes (75 students) of non college-bound or below grade level academic standing, were mostly able to benefit from educational technology when it was used in a form other than drill and practice.

Student responses to many of the interview style questions that were asked, pointed toward a general enthusiasm and appreciation for the presence of technology in their activities. Much of this enthusiasm emerged in the responses to this, "Has this history class been different from other history classes that you have taken throughout high school and middle school? If so, what has made it different?" Many of the students that who were randomly and anonymously asked this question responded with similar answers. The results from this question and others like it, was that the students clearly realize that their intellectual abilities were being exercised.

Many admitted that at first they were frustrated and sometimes annoyed with the amount of work. However, by the end of the assignment, many stated that they obtained a greater appreciation and understanding for the historical material.

Many of the students also appreciated the format in which they were required to research and present their projects. A lot of the student commented on the research capabilities that the Internet offered. They brought up the fact that researching for information on the Internet was almost "less intimidating" than if they were using more traditional methods of study.

As described in the "procedures" section of this study, 10 questions were asked in a rotating fashion, 12 times each throughout the 3 classes (36 groups of two and 3 groups of 1, so 75 students). This process took all of the third day and half of the fourth day of my study.

Many of the answers to the first 5 questions to be asked during the third and fourth day of the study supported my general hypothesis, that the use of educational technology had a positive influence upon critical thinking and analytical skills. I chose to group the responses to each question into 1 of 3 categories, those *positive* responses, that were in support of the hypothesis, those *neutral* responses that were indifferent, and neither supported nor took away from the hypothesis, and finally, the *negative* responses, which did not support the central thesis of the study.

The first five questions that were asked during the third and fourth day of the study were taken from the "sample face to face interview questions," from the original HSRB application. The first question on this list was, "Is this assignment different from other assignments that you have worked on while using the computer? If so, what makes it different?" 20 of the 24 (83.3%) student responses (throughout the three classes) to this question were placed in the *positive* group because they supported my main thesis. Many of the students felt that this assignment was

different because it used technology to engage, " our intellectual skills," as one student put it, rather than, "pointing and clicking for an answer. If it turns red it's wrong, that's it." This response was of course referring to skill and practice exercises that are most likely used with below-grade level and non-college bound students while in the computer labs. 2 of the 24 (8.3%) students were placed in the *neutral* category for this question, because they felt that the assignment was not different from others that used computers. Also, 2 of the 24 students (8.3%) were placed in the *negative* category, because they felt that the assignment was different from other activities, which utilized computers for reasons that did not support the thesis. The student responses in this *negative* percentage included statements like, "The computers make it harder to find information and are distracting to my research." Also, "The WebQuest is confusing, I don't really understand the point of this assignment."

The next question that I asked 12 times to 24 random students over 3 classes, was, "Do you feel that that you have learned more from the activities that use computers in this class than from other classes that have used computers for activities? If so, why?" Again, the majority of the responses to this question were placed in the *positive* category. 18 of the 24 (75%) responses stated that they have eventually learned more from the activities like the WWII WebQuest than from computer related exercises completed in other classes. One student said that, "This WebQuest is hard work, but I feel like I know a lot more about WWII now that I did before." Another student said that, "This assignment is different from a lot of the other stuff that I have done in my other classes on computers. With this, we actually have to apply ourselves, some of the other work on the computers is so easy." These responses certainly support the main thesis and may imply that these students have been exposed to many drill and practice activities while using the computer labs in the school. The responses that were categorized as being *neutral* were

4 out of 24 (16.6%) in number and felt that they were indifferent about their ability to learn, judging from other activities using technology. Only 2 of the 24 (about 4.2%) responses were placed in the *negative* because the responses did not support the thesis. These responses included statements such as, "I feel that I have learned more from other computer activities in other classes, because they were not as difficult as this one."

I also posed this question to students in the three classes on the third and fourth days of the study, "Do you think you have learned more from the computer-based activities or from activities which use the textbook for your history class? Why do you feel this way?" As with the first 2 questions, the majority of the responses were placed in the *positive* category, as many of the students felt that they were able to learn more from using the computers to complete the WebQuest. My results showed that 20 of the 24 (83.3%) student responses were considered to be *positive* and in support of my thesis. Responses like, "Reading the book is very hard for me at times and computers are much more of a part of my everyday life, I just thought it made more sense to do such a big activity as a WebQuest on the computer." Another student stated that, "I was much more comfortable with reading the information from the web sites rather than in books, I was doing a research assignment, but it didn't even feel like one." Again, this was the expected outcome for my study and would prove to be a continued trend throughout the rest of my finding analysis. 3 of the 24 (12.5%) students responded in a manner in which could be considered *neutral* in relevance to my thesis. Only 1 out of 24 (4.1%) students stated that, "I would rather use the textbook to do this work," and thus, was placed in the *negative* category, in opposition to the central idea of the study.

The next question switched gears slightly, it addressed specific long-term outcomes for the uses of technology in the classroom, "Do you think an activity like this WebQuest allows you

to perform better on tests and quiz questions which involve critical thinking, than if you were using your textbook? Why do you feel this way?" The majority of the responses were also categorized as being *positive*. This time, 19 out of 24 (79.1%) of the responses felt that activities which used educational technology resources helped them to perform better on tests and quizzes that contained critical thinking assessments, more so than their textbook. Once again, this substantiated my original thesis. In the *neutral* category for this question, there were 3 (12.5%) responses, which neither supported nor were detrimental to the central idea of the study. However, 2 of the 24 (8.3%) responses were considered to be in the *negative* category and did not support my theory. One of the *negative* responses state that, "reading the text prepares me for taking a test or quiz much more thoroughly. I don't have to hassle with a frozen computer or pop-up ads while trying to study the pages of my book."

To sort of some up my first round of questioning half way through the third day, this was the final question that I posed to 12 of the groups (24 students) over the three classes, "Would you say that the activities that use computers like this one are more challenging, yet also more rewarding than pen and paper activities? If so, what make you say this? If not what would you say about these activities?" This question had multiple parts, but the response break down on the continuum of *positive, neutral,* and, *negative* remained the same. 18 of the 24 (75%) responses were categorized as being *positive*, as they supported using technology to improve critical thinking. One of the *positive* student responses was, "This WebQuest was very difficult to complete, but I was able to work together with my partner, and I now feel that I have a better understanding for the events that took place during WWII." 2 of the 24 (8.3%) responses were indifferent to the question and technology's impact upon critical thinking, thus were categorized as being *neutral*. 16.6% or 4 out of the 24 student responses were grouped in the *negative*

category and did not comply with the thesis. Most of these responses included common complaints with the requirements for the assignment, like this one, "The WebQuest was too difficult and I never really figured out how to answer the question about WWII that I was responsible for."

During the fourth and fifth day of my study, I began asking a second round of interview questions that were modified from the "student survey questions," document that appeared in my original HSRB application. I followed the exact same procedure for this round of questioning (also outlined in the "procedures" section of my research study). The vast percentage of responses for each question were categorized as being *positive* responses for this round of questioning as well, because they gave support to my central thesis.

The first question this list was also asked to 12 groups or 24 random students. I was trying to get a feel for how strong each student was in the discipline of history. So I asked them, "Is history one of your best subjects this school? If yes, have the assignments that you have completed while using computers helped you to feel this way?" A lot of the responses were put into the *positive* category once again, as 20 of the 24 (83.3%) of the responses came back as being "yeses." One "yes" response stated this, "Using the computers for WebQuests gives energetic kids like us a different way to complete tough assignments." None of the responses were consider *neutral*. Finally, 4 of the 24 (16.6%) responses were placed in the *negative* category, as these students did not feel as if the computer-driven activities have helped to make history one of their best subjects. Even within this 16.6% though, one of the "no" responses still stated that, "History will never be one of my best subjects, but the computer stuff makes it less boring."

I also asked this question on the fourth and fifth days of my study, "What has made this history course different from others that you may have taken? If it hasn't been different, why hasn't it been different? On this question, I did not receive as high of a percentage of responses that could be considered in the *positive* category. This time only 10 of the 24 (41.6%) were grouped in the *positive* rankings and stated that the technology resources have made the class different. One of these responses stated that, "I have never really used computers for history the way that I have used them in this class this year. In past history classes we would only used computers to play games or do multiple choice exercises, these activities (WebQuests) are much more fun and I guess I've learned a little also." Again none of responses were applicable to the *neutral* category, and 14 of the 24 (58.3%) were considered to fall in the *negative* category. These *negative* responses did not feel that this course was different from other history courses. One response said that, "We use computers for the same kind of stuff in other classes, but I still think it's better than reading out of the book." As in the previous question, even the *negatively* grouped responses gave partial support to educational technology as being a positive influence upon students.

I next stated this common stereotype about history to the students and asked a follow-up question about the stereotype. This was the how I phrased the question, "History class is commonly stereotyped as being nothing more than a collection of facts and dates. Has this activity served to break this stereotype about history? If so how has it done that?" With this question, the trend of a high percentage of *positive* responses picked back up again. I concluded that 20 of the 24 (83.3%) responses could be considered as *positive* ones. One response from the *positive* grouping stated that, "I agreed with that stereotype until this year. History was always just pointless words to me, but activities like this (WebQuest) bring some of the information

together and it makes more sense." Something like, 8.3% or 2 of the 24 responses were considered *neutral* responses, while I also received the same percentage of *negative* responses that did not support the relationship between educational technology and elevated levels of critical thinking skills. One student said that, "This activity was more fun than reading, but no activity will make history interesting to me, I will never use this stuff once I leave this school."

Next I asked this question, "Do you think that lessons like the one's you have done this week, should be tried by the teachers of your other classes? If yes, why do you think they should be tried? If not why don't you think they should be tried? Once more, I received a large percentage of responses that were put into the *positive* category, as 18 of the 24 (75%) students felt that lesson like the WebQuest should be tried in other classes. One student said this, "If my science teacher tried this with our studies of plants or animals it would be easier for me to do well." 8.3% or 2 of the 24 students gave back *neutral* responses to this question. The *negative* category contained 4 of 24 (16.6%) student responses. Some of the *negative* responses may have been from the same students who were confused by, or did not understand the WebQuest. One response stated that, "If I had to do these sort of activities in my other classes school would become very hard for me."

The final question that I asked 24 random students out of a pool of 75 was this, "Did you feel that this history activity was relevant to your everyday life? Why or why not?" I asked this question last in the effort to wrap up my involvement in the student activities. The percentage results for this question were split almost evenly between the *positive* category and the *negative* category. No responses for this question were categorized as being *neutral.* Almost half of the responses (45.8%) were *positive*, this being an example, "Because of this activity, I can truly say that I have learned something important about World War II. Now I have a better understanding

of the situation that is taking place in 2003 between us and Iraq." The remainder of the responses (54.1%) were *negative*. One the *negative* responses said this, "I did well on this activity, but I don't see how it has anything to do with my life. Hitler and all those other guys from that time are dead now."

During my interview session with the classroom teacher I asked 4 questions. All of the responses (100%) were considered to be in the *positive* category. This was one of the questions that I asked him, "What skills or behaviors are you trying to extrapolate from you students when you plan activities like this WebQuest?" His reply substantiated my theory, "I want my students to be able to take the information and do something useful with it, so thing that they will remember." I also asked this question, "Do you feel that it is important to exercise the critical thinking and analytical skills or your students? Why?" The response that he gave was again supportive to my study, "Of course, students aren't really 'thinking,' unless they do so critically and analytically. I am simply beginning a process that will span a lifetime. Solving complex problems and studying significant issues of the past and present is a necessity for any young person." I next inquired as to how the exercising of critical thinking and analytical skills had an impact upon non-college bound and or below-grade level students. I asked, "How much of a roll should critical and analytical thinking skills play in the education of other students like those in your classes (below grade-level and or non-college bound)?" The teacher replied that, "Again being able to thoroughly analyze the true significance of our history and how it impacts how we live everyday. This is especially true for the kids the I teach." To close my interview with the classroom teacher, I asked him about the future for the inclusion of educational technology resources in the classroom, "Do you feel that significant changes will occur in the curriculum that you use, in order to incorporate the use of educational technology resources to assess critical thinking and

analytical skills? If yes, explain. If no, why not?" He responded like this, "I really hope so, in fact, I have faith that those who administrate our budgets will quickly realize that computers and other educational technology resources are the teaching tools of the future. Every institution in our society functions more effectively through the use of such technologies education should be no exception.

For my last method of research, I simply observed the students as they presented their final WebQuest projects to the rest of their class. All of the projects showed evidence of critical thinking and in depth analysis of the WWII material, and thus substantiated my thesis. Each student also seemed to be significantly more engaged and took more pride in their research presentations. This could be partially credited to the technological format in which they were required to be completed in.

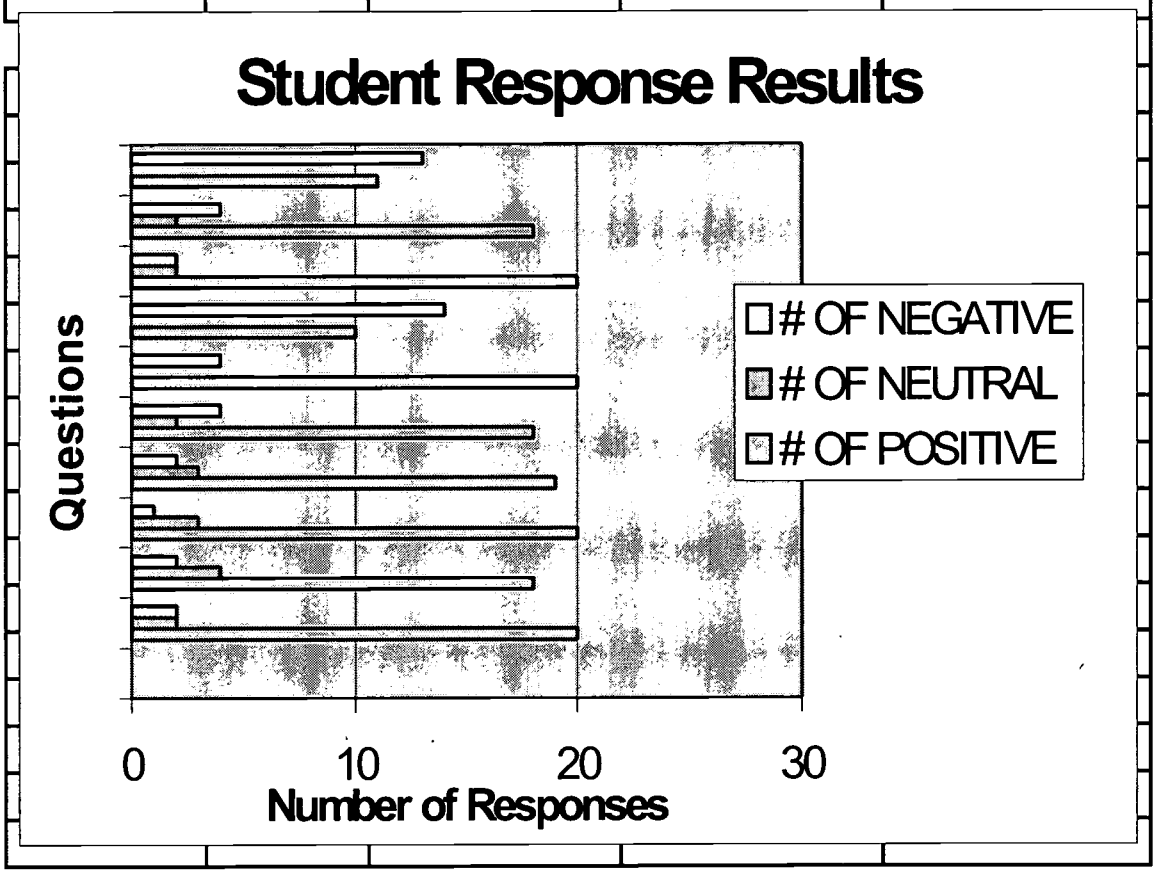
Although many of the responses to these questions supported my original theory that, educational technology resources have a positive impact upon the critical thinking and analytical skills of non-college bound and or below grade-level students, there were some limitations, which hindered my research.

One key limitation that I noticed was that the projects were completed in groups, so when it came time to ask interview questions, many of the students tended to agree with whatever answer their partner had given when I first asked him or her. This limitation was certainly not impossible to overcome, but was a slight drawback to my research process. Another area of weakness that I experienced in my research was that, some of the students appeared to be mildly intimidated by my presence in their room and perhaps their responses to my questions could have been affected accordingly. These limitations were present throughout my entire study, but did not have any major impact upon my work.

Overall, it was clearly evident that my thesis was substantiated through my action research. The 75 students and 1 teacher that I interviewed gave responses, which were in a mostly positive relationship with my thesis. My observations of the final student products also exhibited sustenance to the central theme of my study. I was able to thoroughly conclude that educational technology resources had an affirmative impact upon the critical thinking and analytical skills of below grade-level and non-college bound students.

Student Response Results

QUESTION#		# OF POSITIVE	# OF NEUTRAL	# OF NEGATIVE
1		20	2	2
2		18	4	2
3		20	3	1
4		19	3	2
5		18	2	4
6		20	0	4
7		10	0	14
8		20	2	2
9		18	2	4
10		11	0	13



When my action research concluded, the overall outcome was found to support my central hypothesis. In studying the critical thinking and analytical skill of non-college bound and or below grade-level high schools students, my research determined that educational technology had a positive impact upon these skills. My research group included three classes of 25 students each. The students' perceptions of using computers in the WebQuest format as well as other technology resources were positive. Many students felt that such activities offered a more real-world experience and were more meaningful. Although many students admitted that these activities were more difficult to complete, they also concluded that they had a more substantial understanding of the concept upon completion of the activity.

Perhaps the most valuable outcome of this study is one that is not yet tangible. The long-ranging implications of this study and others like could have a major impact on future of public education. Every day, society moves deeper and deeper into its dependence upon computers, laptops, palm pilots, LCDs, and other electronic devices. These hardware devices drive our businesses, our hospitals, and they are slowly emerging as dominant characteristics in our schools. As schools move closer each day toward engulfing their educational curriculums with educational technology, there must be some notion as how to properly supervise this change. This research shows that using technology alone will not increase student achievement the assignments which utilize the technology must be meaningful and authentic to the students. The underlying goal should always be to provide a "lifelong learning experience" for children in attendance at our schools.

In order to provide these "lifelong learning opportunities" for students, it is also appropriate to realize that *all* students deserve this chance. Preliminary and background research which examined the impacts of educational technology upon student achievement were primarily found to be subjected only to gifted and talented, advanced placement, and or honors students. Of course all these groups are above grade-level achievers and will undoubtedly benefit from this sort of exposure. This same preliminary study of literature about the effects of educational technology upon student achievement uncovered that, when technology was used with under-achieving students, it came in the form of drill and practice exercises which assess rogue memory and recall skills at best. It was therefore more interesting and rewarding to research the impacts that enduring and meaningful, technology-enriched exercises had upon the achievement levels of students who are not college-bound and those who do achieve at their set grade-level. This information could prove extremely valuable in years to come, in order to provide authentic experiences to all students. Movement towards this concept in the field of education would produce perhaps more intellectual and well-round members of our society.

Unfortunately there are also school districts whose budgets do not (or will not) allow funds to be used for the purchase of educational technology resources. I am hopeful that examinations of student performance, which have positive correlations to the use of technology in the classroom-much as this study has-will persuade superintendents and other administrators to reevaluate their decisions not to allocate sufficient funds in the way of educational technology.

The chance to interview an advocate of the integrating technology into the classroom was also rewarding. The teacher in charge of the 75 students in my study, buys into the notion of "lifelong learning." This was of course evident through the WebQuest exercises that were assigned. These projects tested the critical thinking and analytical skills of students, the vast

majority of which were below grade level and or non-college bound. This strategy provided for all students to be subjected to thought-provoking activities and authentic experiences.

It was originally hypothesized at the beginning of my study that motivation, appreciation, understanding, and overall achievement in the subject area would be elevated through the use of educational technology. This theory was confirmed through my action research. The majority of the subjects in my study showed significant and positive growth toward completing and comprehending the assignment. This factor can be strongly associated with the use of educational technology resources rather than more traditional means of instruction.

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